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Artificial Intelligence: The Footstep Headed for Future Supply Chain Management, An Analytical Pedagogy Through the Visionary Eyes of Supply Chain Experts among the Major Ports in India

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ABSTRACT: In this era of repudiation, the world is running at a brisk pace. Anything whether it is an organization, industry or a technology that shouldn't able to cope up with this pace is falling apart. Supply chain management being the fastest growing industrial business sector, needs to be rejuvenated with the technologies within the future. With this aim in mind, researcher had gone through the study to identify whether artificial intelligence is going to be the key players in the future supply chain management in our country. In our country AI has been deployed only to some limited areas of operations and Indian ports are considered to be the fertile land of supply chain experts with vast knowledge about AI. These factors prompted the researcher to deploy his study among the supply chain experts in Indian ports and to find solid answers for the research questions formulated by the researcher. So this research work is set out to explore the role of AI in bringing up a smart and efficient supply chain in the future. At the same time, this study sees the insights of the challenges and major driving forces that will enable the future revolution of AI enabled supply chain. Through the study researcher aims to throw lights into the key areas where AI can be used for getting maximum benefits. The worldwide crave for best supply chain management will find an answer through this research.

Keywords: *Artificial intelligence, supply chain management, key areas of operation, challenges, future revolution*

1. INTRODUCTION:

In today's highly competitive world, every company focuses on providing unique products or services that are differentiated by high quality, cheap cost, and quick delivery. Companies owe it to themselves to seize any opportunity to improve their operations [2]. It is critical to boost supply chain efficiency by making it more adaptable to assimilate any kind of variances in the impulsive business world in order to reinforce a company's commercial, competitive excellence in a constantly changing chain

business world. Supply chains must be handled in such a way that they can respond quickly to fluctuating demand in order to be successful. As a result, modern supply chains are required to respond to client demand quickly, effectively, and efficiently in order to gain a competitive advantage in terms of quality, cost, time to market, and product innovation [5].

Specifically, many industry experts believe that the supply chain of the future will be autonomous and predictive. They claim that this will result in considerable performance improvements in an increasingly complicated and uncertain supply chain management environment [3]. Indeed, supply chains are today confronted with a number of issues as a result of increased internationalization and firm interconnection, as well as increased demand volatility and the demand for faster supply chain speed. The supply chain of the future, driven by new digital technology, will become increasingly self-aware, think for itself, and require minimal, if any, human participation to run its operations [16, 17]. With artificial intelligence, the supply chain's futuristic agility will become a reality [6].

Artificial Intelligence (AI) is on the verge of transforming our world.AI gives chances to complement and supplement human intelligence by enabling high-level cognitive activities such as thinking, perceiving, learning, problem solving, and decision making, along with breakthroughs in data gathering and aggregation, analytics, and computer processing power[13, 14, 15].The world is experimenting with and harnessing the benefits of AI that have yet to be discovered for the betterment of humanity. Dealing with common and complicated global concerns that may be handled by technology intervention is an important aspect of India's AI strategy, and the country's scale and opportunity environment make it the ideal test-bed for ensuring sustainable and scalable solutions. Because of the technology's truly transformative nature and the fact that it is still in its early stages of adoption around the world, India has the opportunity to define its own brand of AI leadership [12]. The brand proposed for India implies inclusive technology leadership, in which the full potential of AI is realized in accordance with the country's unique needs and aspirations. The plan should aim to use AI to drive economic, social, and inclusive growth, as well as serve as a "Garage" for emerging and developing economies.

While AI has the ability to add significant value to a wide range of industries, adoption has thus far been mostly driven by commercial considerations. Recognizing AI's ability to revolutionize economies and the necessity for India to plan its approach, integrating AI's nourishments in supply chain management will result in a technological and financial advancement in the supply chain industry.As more businesses become aware of the opportunities presented by AI and integrate the technology into their existing operations or use it to establish new business models, this research becomes even more important[8].

2. RESEARCH PROBLEM

Nowadays the world is running for technological calls for providing better service to the consumers in every segment of operations and SCM has become an inevitable partner in fulfillment of their motto.SCM is becoming more difficult due to rising supply chain complexity, higher demand volatility, extraordinary technical advancements, and supply chain speed. Academic and practitioner literature shows that smarter supply chains are needed to overcome supply chain risks and vulnerabilities. These supply chains will adjust to changing environments using a variety of technologies, with or without human intervention [10].

Academic research on these and related subjects is limited, despite the promise benefits of the self-thinking supply chain identified in practitioner literature. The systematic literature analysis discovered no publications analyzing the future of self-thinking supply chains facilitated by AI as an emerging trend, and only a few papers alluding to related ideas such as "independent," "prognostic," "smart," or "intelligent" supply chains. Keeping this in mind the researcher had set out the objectives for identifying the role of Artificial Intelligence in creating a smart SCM in India.

Artificial intelligence is finally beginning to show evidence of adding actual value to organizations and their various business processes, such as automating warehouse management, anticipating future trends, and assisting self-driving cars, after decades of development and billions of dollars invested. Even while AI has a lot of potential in terms of helping businesses and supply chain management, it hasn't been fully utilized [9]. Unquestionably the researcher can comment that AI is confined to limited areas of supply chain in India. Through this study researcher aims to find answers to the research question and tries to analyze whether AI is going to rule the supply chain in future India.

3. OBJECTIVES OF THE STUDY

- To uncover the gains of supplanting manual framework with Artificial Intelligence.
- To scrutinize current status of Adoption of artificial intelligence in supply chain management.
- To ascertain the major drivers for the implementation of Artificial intelligence in organization.
- To investigate the zones of appropriateness of Artificial intelligence in supply chain management.
- To disclose the challenges of acquiring Artificial intelligence in supply chain management.

4. RESEARCH METHODOLOGY

The scientific research paradigm is used in this study, which is based on a number of aspects, including the individual's mental model, world view, varied perceptions, beliefs, and attitudes towards reality perception. The researcher establishes a link between the research goals and questions using this methodology. In order to provide good reasons and language for achieving accurate results, this notion emphasizes the researcher's opinions and ideals. Also, this research follows a descriptive research design as the problem statement, research hypothesis, and detailed body of knowledge are clearly defined. The research instrument used in this research in order to gather primary data is a standardized questionnaire prepared by the researcher based on research objectives.

The research instrument is classified into 8 subsections. The research instrument is further submitted to face validity, content validity and concurrent validity using a board of subject experts. As national ports in India are considered as the key area in the supply chain industry and also most developing SCM in both operational and technological levels, 13 major ports in India is considered as the region of the study. The target population of the research is supply chain experts in 13 major ports of the country. The researcher adopted the snow ball sampling technique for effective data collection.

Consequently, the researcher developed and distributed 496 questionnaires to the industry experts in India. After observation, re-examining, and eliminating the unfilled, vague, 476 exclusively filled in questionnaires (95.9 % response rate) are selected for further statistical analysis.

5. ANALYSIS AND DISCUSSION

Level of acceptance by the respondents under various factors of artificial intelligence in supply chain management

5.1. Awareness and basic knowledge about AI

Table 5.1.: Classification based on the acceptance level of respondents on Awareness and basic knowledge about AI

Q.No	Statement	SA	A	N	D	SD
1.	I possess a high degree of knowledge about Artificial Intelligence and its applications	**19.5**	**63.9**	7.1	9.4	0
2.	Organisation is at a highly advanced stage to implement the AI and its applications	2.5	27.3	4.4	**54.5**	**11.3**
3.	Implementing the AI technology will be highly beneficial to the organisation	**28.3**	**53**	11.1	5	2.5
4.	AI enabled service are more effective than ordinary service provider	**34**	**47.8**	6.9	6.3	5

From the above table it is clear that most of the respondents agree to the fact that they have good degree of knowledge about AI, AI implementation will be beneficial and AI enabled services are more effective than normal service provider. On the same time, they disagree to the fact that the organization is at highly advanced stage to implement AI

5.2: Primary reasons for AI adoption

Table 5.2: Classification based on the acceptance level of respondents on Primary reasons for AI adoption

Q.No	Statement	SA	A	N	D	SD
8	It tends to be a noteworthy apparatus in computerized basic leadership	**21.6**	**44.2**	10.1	19.1	5
9	It is helpful for the disposal of manual expenses.	**31**	**46.3**	8.2	7.5	6.9
10	It is useful for taking out manual mistakes and dangers	**21**	**60.2**	2.5	13.8	2.5
11	For Automated information revealing	**39**	**47.2**	6.9	4.4	2.5
12	For lessening time for the finishing of assignments	**36.5**	**51.6**	2.5	6.9	2.5
13	It is a guide for expanding consumer loyalty	**35**	**47.4**	3.8	9.4	4.4
14	It will raise the general nature of the association	**20.8**	**56.2**	3.3	14.9	4.4
15	It can raise the proficiency of tasks or administrations	**33.3**	**53.7**	5.5	5.7	1.9

From the table it is evident that most of the experts have a positive agreeability towards the statements describing the primary reasons of AI adoption. There is very less opinions showing disagree towards the reasons of AI adoption showing that enormous reasons are there to support AI adoption.

5.3: Benefits of Adopting Artificial Intelligence

Table 5.3: Classification based on the acceptance level of respondents on Benefits of Adopting Artificial Intelligence

Q.No	Major benefits in adopting AI	SA	A	N	D	SD
18.	Predictive Analysis acts as a major benefit in implementing AI	**31.9**	**60**	2.5	2.5	3.1
19.	Reduction of time and cost is the major benefit in implementing AI	**31**	**62.1**	5	0	1.9
20.	Improved quality acts as major benefit in implementing AI	**28.9**	**59.7**	1.9	5	4.4
21.	Easiness of operation acts as major benefit in implementing AI	**37.9**	**43.8**	0	15.7	2.5
22.	High accuracy in operations acts as major benefit that influences for implementing AI	**23.1**	**61.6**	0	12.2	3.1
23.	Greater contextual intelligence towards wide range of aspects in supply chain acts as a major benefit that influences in implementing AI	**36.9**	**47.2**	2.5	6.3	7.1
24.	Enhance supply chain management productivity acts as a major benefit that influences in implementing AI	**43.2**	**40.9**	0	8.6	7.3
25.	Quick response to clients acts as major benefit that influences in implementing AI	**23.5**	**64.8**	0	6.7	5
26.	Analyse huge data enhancing demand forecasting accuracy acts as a major benefit that influences in implementing AI	**33.5**	**57.2**	1.3	11.1	1.9
27.	Improved supplier relationship management factor acts as a major benefit that influences in implementing AI	**34.4**	**45.9**	5.5	9.2	5
28.	Enhance production planning and factory scheduling process acts as a major benefit that influences in implementing AI	**30.4**	**50.9**	4	9.2	5.5
29.	Creating workforce optimisation is considered as a major benefit that influences in implementing AI	**38.2**	**44.7**	2.5	9.9	4.8

From the table it is clear that most of the supply chain experts have a positive agreeability towards the statements describing the benefits of AI adoption. There is very less opinions showing disagree towards the benefits of AI adoption ensuring that the benefits of AI adoption is very much attractive.

5.4: Major drivers in artificial Intelligence adoption

Table 5.4: Classification based on the acceptance level of respondents on A Major driver in artificial Intelligence adoption

Q.No	Statement	SA	A	N	D	SD
30.	Performance or transparency of operations drives high in the adoption of artificial intelligence	**38.8**	**41.1**	4.4	10.3	2.5
31.	Automation of operations influences much in the adoption of artificial intelligence	**36.5**	**49.5**	1.3	10.3	2.5
32.	processing power of the organization acts as a major driver in implementing AI	**36.1**	**43.6**	2.7	12.2	5.5
33.	Protectionism or openness of data available influences much in implementing AI in the organisation	**31.7**	**52.8**	4	7.3	4.2
34.	Regulatory environment has a high impact on implementing the AI in the organisation	**28.5**	**52**	1.3	9.9	8.4
35.	Technology war has a high impact on implementing the AI in the organisation	**40.7**	**43**	6.3	9	1

From the table it is apparent that majority of the participants have a positive agreeability towards the statements unfolding the major drivers of AI adoption. There is very less opinions showing disagree towards the drivers of AI adoption confirming that these driving forces favors AI adoption

5.5: Key areas of application of AI in supply chain management

Table 5.5: Classification based on the acceptance level of respondents on Key areas of application of AI in supply chain management

Q.No	Key Areas Where AI Can Be Adopted	SA	A	N	D	SD
36	Supply chain Decision making is considered as one of the important area for the application of AI	**38.8**	**41.9**	1.9	10.9	6.5
37	Inventory control and planning is considered as one of the important area for the application of AI	**37.1**	**41.1**	1.9	13.8	6.1
38	Transportation network design is considered as the key area for the application of AI	**36.9**	**43.8**	2.5	14.5	2.3
39	Purchasing and supply management is considered as the important area for the application of AI	**32.7**	**48**	5	7.3	6.9
40	Demand planning and forecasting is considered as one of the important area for the application of AI	**30.2**	**50.5**	1.9	9.6	7.8
41	Customer relationship management is considered as one of the important area for the application of AI	**31.7**	**45.3**	2.9	15.3	4.8
42	Order picking issues is considered as one of the important area for the application of AI	**35**	**45.3**	4.2	4.4	11.1
43	Customer data base management is considered as one of the important area for the application of AI	**26.2**	**51.6**	4.4	10.3	7.5
44	Safety alert systems for mal functioning or any emergency is considered as the key area for the application of AI	**43.2**	**36.9**	0	10.5	9.4

45	Location planning is considered as one of the important area for the application of AI	**37.3**	**33.8**	7.3	7.3	14.3
46	Freight consolidation and management is considered as one of the important area for the application of AI	**30.8**	**41.1**	4.8	19.5	3.8
47	Financial alert system for clients as well as employees is considered as the key area for the application of AI	**25.6**	**49.1**	6.5	10.7	8.2

From the table it is visible that mainstream of the participants has a positive agreeability towards the statements recounting the key areas of AI adoption. There are very less opinions showing disagree to the key areas of AI adoption confirming that there exist mammoth areas where AI adoption will be beneficial to the supply chain management.

5.7 ANNOVA

5.7.1: Benefits level of AI implementation and AI adoption strategy

Objective: To analyze the level of understanding of the AI adoption strategyand compare based on benefits level of AI implementation. The hypothesis and analysis are done through the ANOVA method.

Null Hypothesis H_0: There is no significant difference between benefits level of AI implementation and AI adoption strategy

Alternate hypothesis H_1: There is a significant difference between benefits level of AI implementation and AI adoption strategy

The hypothesis is to check whether difference exists between AI adoption strategies when considering the benefits level of AI implementation. If any basic difference exists among the groups, it can be witnessed in the descriptive Table of ANOVA below.

Table 5.7.1A: ANOVA best strategy wise comparison of the study variables

ANOVA					
Best strategy for Organization					
	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	1.668	4	.417	4.743	**.001**
Within Groups	41.502	472	.088		
Total	43.170	477			

Inference:

In this analysis, it is clear that level of significance value is less than 0.05, hence null hypothesis is rejected and alternate hypothesis is accepted. This proves that there is significant association between benefits level of AI implementation and AI adoption strategy. Thus it can be concluded that different levels of benefits have relationship in best strategy decision in AI adoption in supply chain management.

5.7.2: FUTURE TECHNOLOGY AND CHALLENGES

Null hypothesis H_0: There is no significant association between challenges of AI and future technology in SCM

Alternate hypothesis H_1: There is a significant association between challenges of AI and future technology in SCM

Table 5.8.2.B: ANOVA comparison of the study variables

ANOVA					
Challenges*future technology in SCM					
	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	.664	2	.332	2.040	**.003**
Within Groups	77.201	474	.163		
Total	77.866	476			

In this analysis, it is clear that level of significance value is less than 0.05, hence null hypothesis is rejected and alternate hypothesis is accepted. This proves that there is significant association between challenges of AI and future technology in SCM.Thus it can be concluded that there is relationship between challenges of AI and opinion on future technology in SCM.

5.8 CORRELATION ANALYSIS

5.8.1: Table showing correlation analysis on Benefit level of AI implementation and AI adoption strategy

Benefits level of AI implementation	Pearson Correlation	.511**
	Sig. (2-tailed)	**.000**
	N	477

From the above Table, it is evident that correlation is significant at the 0.01 level (2-tailed). It is apparent that there is a positive correlation between benefit level of AI implementation and AI adoption strategy. Since the correlation co efficient value is .511, it indicates that there exists a moderate positive correlation among the variables.

5.8.2: Table showing correlation analysis on benefits of AI implementation and key areas of AI implementation

Correlations			BENEFITS	KEYAREAS
Spearman's	BENEFIT	Correlation Coefficient	1.000	.391**
		Sig. (2-tailed)	.	.000

		N	477	477
	KEYAREAS	Correlation Coefficient	.391**	1.000
		Sig. (2-tailed)	.000	.
		N	477	477

From the above Table, it is evident that correlation is significant at the 0.01 level (2-tailed). It is apparent that there is a positive correlation between benefits of AI implementation and key areas of AI implementation. Since the correlation co efficient value is .391, it indicates that there exists a weak positive correlation among the variables.

5.8.3: Table showing correlation analysis on Effectiveness of AI enabled services and future technology in SCM

Effectiveness of AI enabled services	Pearson Correlation	.578**
	Sig. (2-tailed)	**.000**
	N	477

From the above Table, it is clear that correlation is significant at the 0.01 level (2-tailed). It is obvious that there is a positive correlation between Effectiveness of AI enabled services and future technology in SCM. Since the correlation co efficient value is .578, it indicates that there exists a moderate positive correlation among the variables.

5.9. CHI SQUARE ANALYSIS

5.9.1: Outcomes of AI Implementation and Adoption Strategy.

Null hypothesis H_0: There is no significant association between outcomes of AI implementation and Adoption strategy

Alternate hypothesis H_1: There is a significant association between outcomes of AI implementation and Adoption strategy

Table 5.9.1. Table showing opinion on Best strategy for Organization * AI adoption will be favorable to the organization

Chi-Square Tests			
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	29.024[a]	4	**.000**
Likelihood Ratio	44.560	4	.000
Linear-by-Linear Association	4.655	1	.031
N of Valid Cases	477		

a. 2 cells (20.0%) have expected count less than 5. The minimum expected count is 1.21.

Inference: In this analysis, it is clear that significance value is less than 0.05, hence null hypothesis is rejected and alternate hypothesis is accepted. This proves that there is significant association between outcomes of AI implementation and Adoption strategy..Thus, it is evident thatoutcomes of AI implementation have an impact on AI adoption.

5.10.2: AI adoption strategy and key areas of implementation

Null hypothesis H_0: There is no significant relationship between AI adoption strategy and key areas of implementation

Alternate hypothesis H_1: There is a significant relationship between AI adoption strategy and key areas of implementation

Table 5.10.2: Table showing test value of Key areas of implementation and best strategy for organization

Chi-Square Tests					
	Value	Df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	2.406[a]	1	.021		
Continuity Correction[b]	4.863	1	.022		
Likelihood Ratio	2.684	1	.001		
Fisher's Exact Test				.038	**.041**
Linear-by-Linear Association	2.401	1	.021		
N of Valid Cases	477				
a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 10.16.					
b. Computed only for a 2x2 table					

Inference: In this analysis, it is apparent that significance value is less than 0.05, hence null hypothesis is abandoned and alternate hypothesis is accepted. This proves that there is significant connection between key areas of operation and best strategy for organization. Thus, it is evident that key areas of AI have an impact on best strategy for organization.

6. SUGGESTIONS

For adoption of highly advanced technology like AI in SCM, requires proper structured planning as well as human and technology resources for handling it. So, it is increasingly important for SC partners to update their knowledge bases and automate the SC decision-making processes [1]. Thus, AI has been put forward as an effective managerial aid tool that helps the firm to connect its customers, suppliers, and SC under the same roof. Based on the analysis, the certain points to be noted are,

- From the analysis, it is clear that most of the experts expressed that their organization is not in an advanced stage to implement AI. Thus proper awareness and technical developments should be developed for proper implementation.
- Firms should develop themselves to advanced stage for adapting to booming technology like AI.
- More emphasis need to be given to areas like purchasing and supply management, order picking issues and freight consolidation management as these areas need to be improved under AI.
- More funds should be invested on R&D on AI for getting better outcomes in unexplored areas.
- High implementation cost is required for the adoption of AI, thus proper planning and level by level adoption can be a good idea for managing funds.

7. CONCLUSION

Now a day SCM is one of the booming areas of business where advanced technology is required.AI is an opportunity to challenge the existing models of supply chain management. It will help organizations manage the supply chain complexities efficiently and reap all the opportunities using technology in the digital world. There are multiple advantages of applying AI in the supply chain. Despite the opportunities offered, very few organizations are either adopting it or are equipped to adopt AI. In this research, researcher discusses the opportunities offered by AI, as well as the roadblocks that organizations are facing to adopt AI in complex supply chain management [4]. This technology is at an early stage of development in our country especially in the field of supply chain management. With promising benefits in this growing field, AI is proven to be most beneficial in most key areas of supply chain management. AI with its wide acceptance and efficiency can be adopted in key areas of SCM.

CONFLICTS OF INTEREST

There are no conflicts to declare.

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